**SIMULTANEOUS RECOVERY AND CONCENTRATION OF Zn(II) AND Cu(II) IN DOUBLE MULTIMEMBRANE HYBRID SYSTEM (D-MHS)**

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This work deals with functioning of a double multimembrane hybrid system (D-MHS) of the composition:

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Strip-1
H2SO4  CEM  NAFION  LM-1  CEM  NAFION  CEM  NAFION  LM-2  CEM  NAFION
 Strip-2
H2SO4
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where CEM denotes a cation exchange membrane, f – feed solution, s – stripping solution and LM – liquid membrane.

The main aim of this study was to design an experimental D-MHS system sufficient for the simultaneous recovery and separation of Zn$^{2+}$ and Cu$^{2+}$ from dilute aqueous solutions. According to the above-presented scheme, the D-MHS operation involves a series of ion-exchange-diffusion processes (in CEMs) coupled to the LM transports mediated by two different carriers. It was found experimentally that the D-MHS separation ability depends mainly on the composition of an organic phase and, specifically, on the carrier properties. Some representative results corresponding with D-MHS with Acorga P-50 and Cyanex 302 (or D2EHPA) as the selective carriers of Zn$^{2+}$ and Cu$^{2+}$, respectively, are listed in Tab.1.

**Table. 1. Fluxes in the D-MHS system: feed: 0.01 M Zn(NO$_3$)$_2$ and Cu(NO$_3$)$_2$; strip 1 M H$_2$SO$_4$, LM 0.1 M carrier in kerosene**

<table>
<thead>
<tr>
<th>LM-1</th>
<th>LM-2</th>
<th>Zn$^{2+}$ Fluxes [mol/cm's]</th>
<th>Cu$^{2+}$ Fluxes [mol/cm's]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S-1</td>
<td>S-2</td>
</tr>
<tr>
<td>Cyanex 302</td>
<td>Acorga P-50</td>
<td>1,6×10$^{-10}$</td>
<td>1,1×10$^{-14}$</td>
</tr>
<tr>
<td>D2EHPA</td>
<td>Acorga P-50</td>
<td>6,2×10$^{-10}$</td>
<td>8,8×10$^{-11}$</td>
</tr>
</tbody>
</table>

The results of this study prove that two simultaneously operating MHS systems allow the efficient separation and recovery of two cations. The optimization of the carrier concentration in a given liquid membrane and the concentration of the stripping agent in external stripping solutions could enhance the system performances.